Team Perchance Executive Summary

A) Introduction to Problem Statement and Approach

Singapore's highways experience a significant number of traffic accidents each year, reaching over 7000 accidents with injuries in 2024, along with fatalities and accident rates increasing since 2023.

While the Intelligent Transport Systems (ITS) Operations Control Centre (OCC) and the Expressway Monitoring Advisory System (**EMAS**) have enhanced traffic monitoring, these solutions remain **reactive**, requiring precious time for manual verification and intervention. This delay in response time can lead to increased congestion, secondary accidents, and even loss of lives.

Our solution, **SAME** (Software Advisor for Monitoring of Expressways), enhances existing ITS EMAS systems by leveraging different computer vision and AI techniques to automate real-time accident detection, monitor traffic flow, and provide predictive insights for both operators and planners.

B) Our Solution

SAME includes these key features & enhancements;

1. Real-Time Traffic Monitoring of LTA camera feeds with CV techniques
    - Vehicle detection using object detection, accident detection with image classification, and optical flow analysis
    - Stores data in a centralized database for real-time monitoring and historical analysis

2. Interactive Live Map for Traffic Operators
    - Provides a visual representation of Singapore's highways, showing precise camera locations and angles, real-time traffic conditions, and accident alerts
    - Operators can instantly verify traffic incidents once alerted by clicking on camera feeds, improving response efficiency

3. Real-time Traffic Overview and Analysis Dashboard
    - Aggregates real-time trends on traffic density, vehicle counts, accident alerts, and weather
    - Discerns risks based on sudden changes in traffic conditions
    - Prioritizes high-risk areas, ensuring operators can focus on more critical regions

4. AI-Driven Traffic Planning via LLM Debate System
    - Uses historic, region-specific accident data to generate a queryable factor DAG
    - Two specialized LLM models engage in rounds of structured discussions:
        - One proposes innovative solutions for traffic management
        - The second evaluates feasibility, ensuring realistic and data-driven recommendations

SAME hopes to transform traffic planning and operations by providing;

- Predictive insights for planners to prepare for incidents, enabling proactive measures to reduce congestion and accident risks.
- Enhanced situational awareness for traffic operators through automated monitoring and intelligent alert systems.
- Faster response in incident detection and verification, leading to quicker emergency responses.
- Improved long-term traffic planning using AI-powered analysis and recommendation systems.

C) Summary

By integrating AI-driven automation, predictive analytics, and intelligent decision-making, SAME transforms traffic management from a reactive process to a proactive strategy, ultimately making Singapore's roads safer, smarter, and more efficient.